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THE MINERALS INDUSTRY OF MOZAMBIQUE

IMR SADCC MINING PROJECT FUNDED BY SAREC

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REPORT NO. 83

MAY 1986

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The minerals industry of Mozambique

By Paul Jourdan

Mozambique's mineral industry is one of the smallest in the SADCC, due more to neglect during the five decades of Portuguese colonialism than to a lack of resources. From independence in 1975 the new Frelimo government made rapid progress in mineral exploration and was at the point of a major expansion in exploitation when, from 1981, the South African regime stepped up and intensified the destabilization of Mozambique.

Background

The Island of Mozambique, from whence the country gets its name, was an Arab trading centre, handling gold, ivory and slaves from the African interior. It was taken over by the Portuguese in the sixteenth century, who also occupied several other ports along the coast, but they did not colonise the hinterland until the last century.

In the wake of the British and French decolonisation of Africa in the late fifties and early sixties, a nationalist movement, the Front for the Liberation of Mozambique (Frelimo), was formed in 1962 from several other organizations in Dar es Salaam in neighbouring Tanzania.

In 1964 Frelimo launched an armed liberation struggle against the Portuguese who had made it clear that they were not at that time willing to follow the lead of the other major European colonizers by giving independence peacefully to their colonies.

By 1974 it had become clear to a group of officers in the Portuguese army that they were slowly losing their colonial wars and that the cost to the metropolitan economy was greater than the benefits derived from having an "empire". In April of that year there was a coup in Lisbon against the fascist government that had held power since the late twenties, carried out by officers from the colonial armies, the Armed Forces Movement, (MFA).

In September 1974 the MFA and Frelimo signed the Lusaka accords whereby hostilities would cease immediately and the "province" of Mozambique would be administered by a joint transitional government until full independence was granted.

The Peoples Republic of Mozambique (PRM) came into being on the 25th of June 1975 under Frelimo which inherited a backward colonial economy dependent not only on Portugal but also on neighbouring white-ruled South Africa. In 1973 imports stood at 11.4 billion meticaïs (G MZE) while exports

were less than half this value at 5.54 G MZE. Invisibles made up 3.5 G MZE leaving a negative balance of -2.4 G MZE (Table 1). Most of the invisibles came from South Africa in the form of tourism, transport (ports and railways) and the repatriation of miners' salaries.

In 1973 the port of Maputo handled 6.6 Mt of cargo, mainly for South Africa. By 1983 this had fallen to 1.1 Mt. Over the same period the number of Mozambicans working on South African mines fell from 99.4 thousand to 45.5 thousand.¹

From 1973, when it became apparent that the war was going badly, the 250 thousand settlers started to leave Mozambique. In 1974 the exodus increased and after independence in 1975 most of the remainder panicked and by the end of 1976 there were only a few thousand left.

Thus Mozambique had lost over 80 per cent of its skilled technicians by the second year of independence. This was the main contributor to the rapid economic decline in 1975, 1976 and 1977. By 1978 the slide had been halted and the economy once again started to show positive growth through to 1981 (Table 1), despite the undeclared war with the then Rhodesia which had started with the Mozambican imposition of UN sanctions in March of 1976 and continued until the collapse of the rebel settler regime in February 1980. The total cost of supporting the Zimbabwean struggle was estimated at 556 M USD in 1983, more than the total export earnings over the three years 1977 to 1979.²

From 1981 the economy once again went into decline, this time due to South African destabilization, both direct and indirect via the South African run MNR (Mozambican National Resistance) bandit activities.

In March 1984 Mozambique and South Africa signed the, now infamous, Nkomati Accord whereby Mozambique would cease to allow its territory to be used by the African National Congress (ANC) to infiltrate South Africa and, in

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Table 1**Basic economic and mining data (GMZE)**

Year	Exports	Imports	Balance	GSP ^a	GIP ^b	Mining	% ^c	MZE* = USD
1973	5.54	11.42	— 5.87	111.9	42.1	0.51	1.2	na
1974	7.56	11.74	— 4.18	91.5	34.6	0.60	1.7	na
1975	5.05	10.75	— 5.70	71.1	26.4	0.69	2.6	27.24
1976	4.52	9.06	— 4.53	na	26.6	0.63	2.4	31.41
1977	4.92	10.82	— 5.90	75.0	27.8	0.44	1.6	32.22
1978	5.34	17.20	—11.85	na	30.3	0.33	1.1	32.88
1979	8.31	18.58	—10.26	na	28.6	0.31	1.1	32.71
1980	9.10	25.92	—16.83	82.2	30.7	0.36	1.2	32.40
1981	9.93	28.32	—18.39	83.7	31.6	0.58	1.8	35.35
1982	8.66	31.57	—22.92	77.9	27.2	0.38	1.4	37.77
1983	5.29	25.57	—20.28	63.9	22.5	0.21	0.9	40.18
1984	4.06	22.90	—18.84	55.6	15.5	0.15	1.0	42.44

Notes:^a GSP = Gross Social Product in 1980 constant prices.^b GIP = Gross Industrial Product (1980 prices).^c % Mining of GIP.

* MZE = metical (national currency).

Source:

CNP, 1985.

Table 2**SADCC: Basic economic and mineral data (1983, USD)**

Country	Area Kkm ²	Pop'n Mil	GDP G USD	The economy		Exp'ts M USD	The minerals sector			
				GNP/ cap	Debt G USD		Prod'n M USD	% GDP	% Exp't	%** Emp't
Angola	1 247	8.2	4.00	500	0.15	1 740	1 646	25	94	9
Botswana	600	1.0	0.89	833	0.21	611	590	28	75	27
Lesotho	30	1.5	0.35	460	0.15	47	19	1	41	9
Malawi	118	6.6	1.33	210	0.72	220	7	0	0	1
Mozambique	799	13.2	1.70	130	1.66	132	5	1	2	1
Swaziland	17	0.7	0.50	870	0.20	271	23	3	5	3
Tanzania	945	20.8	4.55	240	2.58	566	45	2	8	2
Zambia	753	6.3	3.35	580	2.64	869	1 040	15	96	16
Zimbabwe	391	7.9	4.73	740	1.50	1 133	470	8	37	6
Total (avg)	4 900	66.2	21.29	322*	9.81	5 589	3 845	11*	61*	
% Moz. ***	16	19.9	7.47	47	17	2	0.13	0.7	0.08	

Notes:

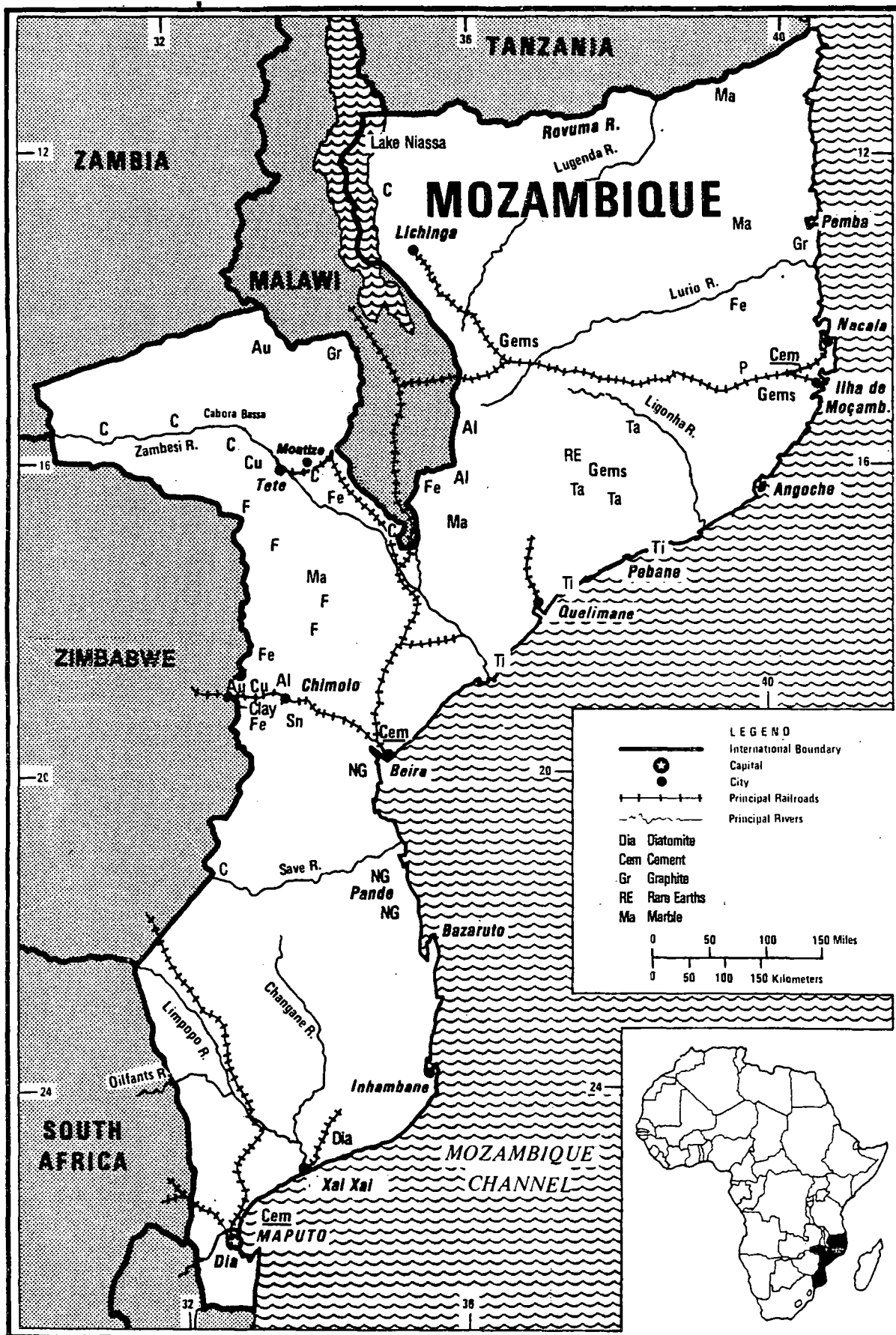
* weighted average.

** % total formal employment.

*** % Mozambique of SADCC total or SADCC average.

Sources:

SADCC, 1985; CNP, 1985 and Government statistics from the SADCC countries.



exchange, that country would cease training and supplying the MNR bandits. In the past two years there has been ample evidence proving that South Africa has continued to run the MNR, even though Mozambique has kept strictly to its side of the bargain.

The security situation improved somewhat in 1985, especially in the centre of the country where Zimbabwean troops were deployed principally to guard the Mutare-Beira corridor, but the Mozambican economy is still a long way from recovery. MNR activities are now mainly concentrated in areas close to their rear bases, namely Zambezia Province (operating from Malawi) and Maputo Province (operating from South Africa).

Mozambique's main exports have always been agricultural. In 1973 they were cotton 20 per cent of exports, cashew nuts 18 per cent, sugar 10 per cent, wood 5 per cent, petroleum products 5 per cent, tea 4 per cent copra 4 per cent and prawns 2 per cent. By 1984 the principal exports were prawns 30 per cent,

cashew nuts 16 per cent, tea 11 per cent, cotton 8 per cent, sugar 6 per cent, petroleum products 6 per cent and citrus fruit 3 per cent.³ The banditry in the countryside has made it difficult for crops to be planted and marketed which is in part responsible for the ascendance of prawns as the main export, as it is a relatively "bandit free" product.

The mining industry

The mining industry of Mozambique has always been tiny in comparison to other countries in the region. Table 2 gives its position in the SADCC in 1983. In that year mining contributed less than 1 per cent of the country's Gross Social Product (GSP), a mere 2 per cent of national exports and 0.08 per cent of total SADCC mineral exports.

From 1975 to 1984 the contribution of the mining sector to the Gross Industrial Product (GIP) fell by 62 per cent from 2.6 per cent to 1 per cent and in absolute terms it fell 70 per cent from 510 M MZE to 150 M MZE, mainly due to the effects of banditry as mines tend

to be more isolated than other sectors of the economy (Table 1).

In 1981 mineral exports of 25 M USD made up 8.9 per cent of total foreign exchange receipts of 281 M USD. Export earnings from mining in 1985 are expected to be 2 M USD and total earnings 80 to 90 M USD due to the destabilization of the economy. Planned mineral exports for 1986, before the deterioration of the security situation, were 55 M USD but are likely to be a twentieth of this figure.

At independence in 1975 the mining industry was totally in private hands. In 1978 and 1979 all of the mining companies were nationalized. At this time mining came under the Ministry of Industry and Energy and two state mining companies were created to run the new acquisitions: *Carbomoc* for coal and *MAGMA* (Empresa Nacional de Minas) for other minerals.

In 1983 the *Ministry of Mineral Resources* (MIREM) was formed with responsibility for mineral exploration and exploitation. MIREM has under it:

- The National Institute of Geology (ING) Geological Survey Dept,
- The National Directorate for Hydrocarbons (DNH) for gas and oil,
- The Coal Cabinet (GPC) for coal and,
- The National Directorate of Mines (DNM) for other minerals.

In addition to the two state companies mentioned above, a state company for semi-precious stones (GPL) was created and in 1980 the *National Hydrocarbon Company* (ENH) was formed to handle oil and gas exploration and exploitation contracts.

Coal

Coal is, under normal circumstances, the most important mineral in terms of both production and exports. In 1975 coal mining contributed 60 per cent of total mineral production and 3.5 per cent of total exports. By 1984 these figures had fallen to 21 per cent and 0.5 per cent respectively. Coal production fell

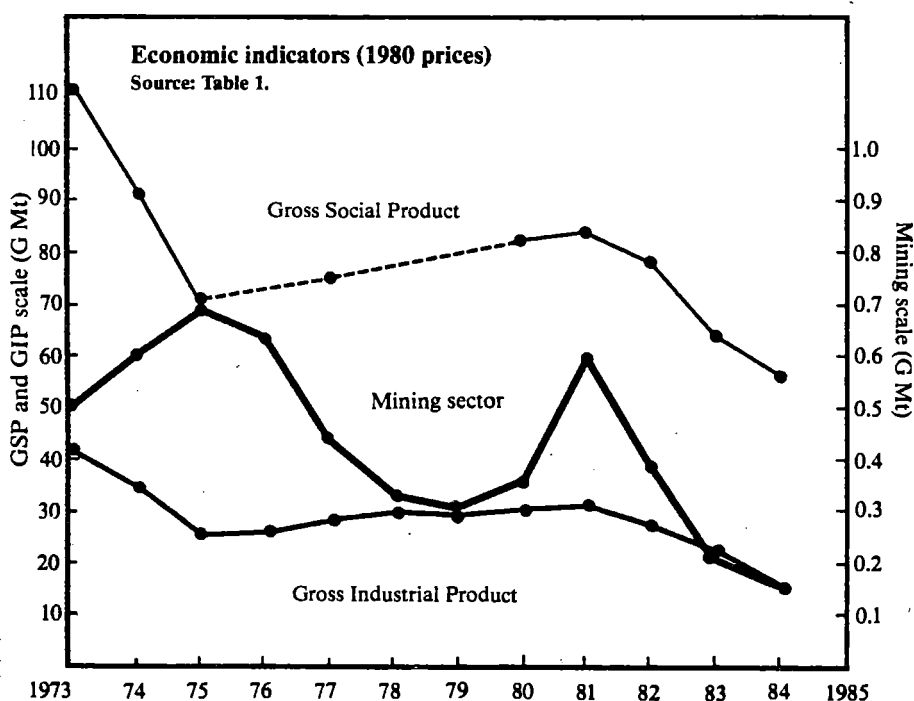


Table 3**Mozambique: mineral production; mining and refining
(in t)**

	1973	1975	1977	1979	1981	1983	1985	1973—1983	
								% Chg	Average
Asbestos	150	191	0	789	1 424	0	55	—100	426
Bentonite	2 990	1 400	2 643	1 657	716	1 455	361	—51	1 810
Coal (kt)	394	575	288	320	535	59	20	—85	362
coking (kt)	216	316	178	105	167	30	na	—86	169
steam (kt)	178	259	147	95	163	28	na	—84	145
Copper ^a	3 175	3 224	0	1 125	880	1 189	590	—63	1 599
Felspar	830	0	815	585	775	696	67	—16	617
Garnets, gem	3.54	2.41	1.79	1.28	1.80	1.27	0.87	—64	2.02
waste	6.45	6.93	5.80	8.23	11.01	9.68	6.87	7	8.02
Kaolin	100	119	201	139	297	292	152	192	191
Marble (m ³)	368	0	0	304	167	406	714	10	207
Mica, waste	280	900	432	101	300	309	na	10	387
Microlite ^b	53.84	50.74	40.85	34.90	48.70	23.17	6.28	—57	42
Stone (m ³)	200	197	200	192	579	417	na	108	297
Tantalite ^b	30.28	51.03	37.63	23.60	34.08	21.65	4.28	—29	33
Ta ₂ O ₅	33.03	39.99	32.05	29.06	46.20	21.16	na	—36	34

Notes:^a concentrate, 20 % Cu.^b concentrate.**Sources:**

CNP, 1985; MIREM, 1985 and 1986; DNM, 1986.

Table 4**Mines: reserves, capacity utilization and stocks, 1985**

	Units	Reserves	Grade	Capacity	% use ^a	Stocks
Asbestos (Mavita)	kt	12.6	nap	1.2	5	1.96
Bentonite (Luzinada)	kt	2 452	nap	6.0	6	0.0
Coal (Moatize)	Mt	600	nap	0.8	3	na
Copper (Mundonguara)	kt	280	3.1 %	2.6	23	0.73
Felspar (Tulua)	kt	12	nap	1.2	6	0.0
Marble (Montepuez)	Mm ³	25.8	nap	1.3	55	1.24
Ta ₂ O ₅ : Total	ton	5 768 ^b	538 ppm	61	8	10e
Morrua	ton	3 789 ^b	735 ppm	35	na	—
Marropino	ton	1 029 ^b	160 ppm	13	na	—
Muiane	ton	950 ^b	160 ppm	13	na	—

Notes:^a % capacity utilization in 1985.^b refers tons Ta₂O₅.**Sources:**

SADCC, 1985; MIREM, 1985; DNM, 1986.

from 575 kt to 59 kt over the same period (Table 3). Coal exports in 1980 were 99 kt worth 122 M MZE, 39 per cent of total mineral exports (Table 5). In that year tantalum pentoxide exports were worth more, at 164 M MZE, due to an exceptionally high tantalum price on the world market at that time. By 1984 coal exports had fallen 85 per cent to 15 kt, 21 per cent of total mineral exports of 106 M MZE (Table 5).

The coal mines are in the Moatize Basin in Tete Province. They used to be owned by the Companhia Carbonifera de Mocambique, a subsidiary of Union Minière (Belgium) but were nationalized in 1977 after a major colliery disaster in which 130 miners lost their lives. Since then they have been run by Carbomoc (state coal mining company) and technical services have been supplied by the German Democratic Republic.

There are four underground mines, each with an annual capacity of 150 to 200 kt. The total installed capacity is 800 kt of coking and steam coal (1:1). Since 1981 production has fallen radically (by

90 per cent) due to the sabotage of the railway from Moatize to the port of Beira. The only exports in 1985 were to neighbouring Malawi by road (about 20 kt/year). In 1983 there were 2,163 employees, a 280 per cent increase on 10 years earlier (762). Of these 78 were professionals, 680 skilled and semi-skilled and 1 405 unskilled. Of the professionals 73 were expatriates. Productivity for the company as a whole decreased from 1.70 t/person-shift in 1973 to 0.09 in 1983.

In 1985 confirmed reserves in this basin were put at 489.8 Mt and resources were estimated at 1 Gt⁴. Planned production, before the breakdown of the railway, was forecast at 1.8 Mt worth roughly 50 M USD in foreign exchange for 1986, increasing to 5 Mt in 1995, almost all for export.

Actual production in 1985 was roughly 20 kt. Under normal circumstances the domestic market consumes 160 to 180 kt of steam coal annually mainly by the Maputo power station. Due to the location of the Moatize mines it is

cheaper to import coal for Maputo from South Africa (or Swaziland) than to bring it from Moatize (see map).

Assistance is at present being sought to carry out an evaluation of the Mozambican coal resources. There are several other basins the most important of which are Mucanha-Vuzi Basin on the northern edge of Lake Cahora Bassa, Minjova Basin to the east of the Moatize Basin, the Sanangoe Basin south of Cahora Bassa Dam and, out of the Zambezi Rift, the Metangula Basin in Niassa Province and a small deposit near Espungabera on the Zimbabwean border. Most of these deposits are medium to high ash steam coal.

At present there are no plans for the exploitation of the other basins as Moatize has ample reserves of good coking coal and steam coal. In 1984 the coal resources in the Zambezi Rift were put at 7.5 Gt (Moatize, Minjova and Mucanha-Vuzi).

Pegmatites

The most important product from the small scale pegmatite workings is tantalum. Most of the workings are in Zambezia and Nampula Provinces. The tantalum/niobium minerals produced are tantalite and microlite and are exported as a concentrate.

Production of contained Ta_2O_5 increased by 40 per cent from 1973 (33t) to 1981 (46t) before falling to about 5t in 1985 due to increased bandit activity in the area. Exports in 1975 were 88 tons worth 32 M MZE, but had fallen 73 per cent to 24 tons by 1984 (Table 5). Planned exports, under normal conditions, for 1986 would have been 120 tons of Ta_2O_5 worth roughly 10 M USD in export receipts, but due to the security problems only 5 per cent of this figure is expected.

In 1975 the US Bureau of Mines estimated the Mozambican tantalum resources to be 4.4 kt or 1.7 per cent of the world total,⁵ but at this time the tantalum pegmatite areas of Mozambique had not been geologically mapped. The

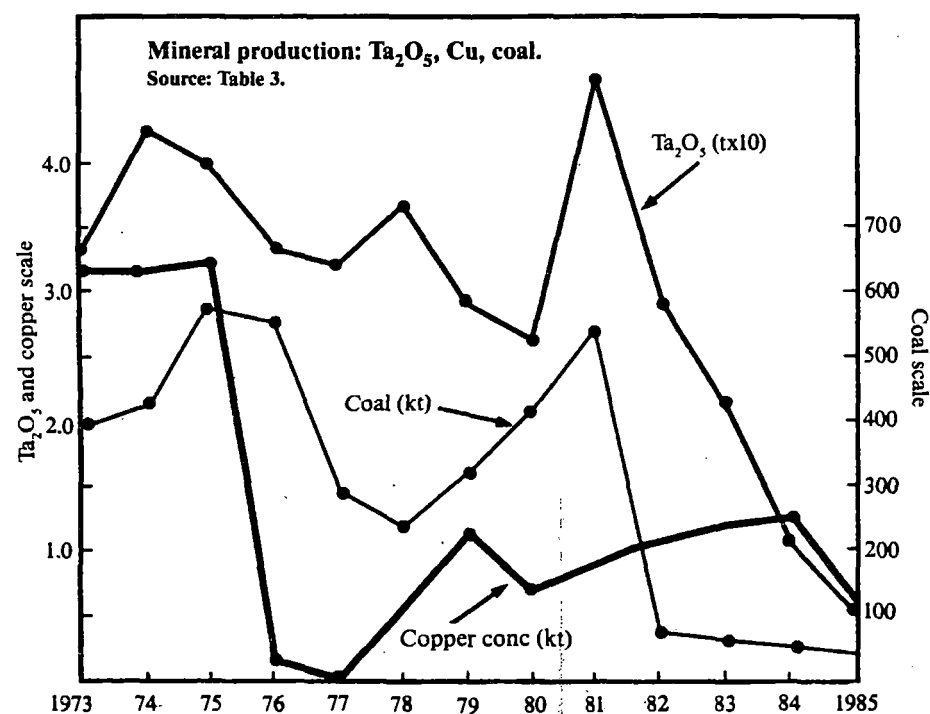


Table 5**Mineral exports: 1978, 1980, 1984**
(in M MZE)

Mineral	1978		1980		1984		Rank ^a 1984
	Value	Vol	Value	Vol	Value	Vol	
Asbestos (kt)	3.01	0.42	1.70	0.21	2.73	0.24	5
Bentonite (kt)	0.53	1.55	1.04	0.61	0.08	0.02	8
Beryl (t)	0.36	31	0.52	33	0.48	17	7
Coal (kt)	41.30	38.8	121.70	98.5	22.60	15.1	2
Copper (kt)	2.21	1.20	7.53	1.40	3.37	1.00	4
Garnets (t)	—	—	—	—	17.36	34.00	3
S-P Stones ^b	0.01	—	8.09	—	1.07	—	6
Ta ₂ O ₅ (t)	44.10	48.2	163.70	44.0	58.00	24.0	1
Others	29.80	—	7.39	—	0.50	—	
Total ex-cement	121.32	—	311.27	—	106.19	—	
Cement (kt)	210.90	185.0	130.28	99.6	36.00	26.1	
Clinker (kt)	11.20	18.1	21.20	26.0	9.40	8.6	
Total ^c	333.42	—	462.67	—	151.59	—	
Total M USD^d	10.1	—	14.3	—	3.6	—	

Notes:^a Rank by value in 1984.^b Polished semi-precious stones.^c Including cement and clinker.^d Historical USD.**Sources:**

MIREM, 1985; CNP, 1985.

Table 6**Geological exploration activity**
Thousand (km)²

Activity	Pre 1975	1975—1985	%*
Geological mapping:			
1:250 000	467.42	478.59	51
1:100 000	—	345.00	100
1:50 000	—	35.00	100
Airborne geophysical mapping:			
1:250 000	496.02	476.65	49
1:100 000	—	476.65	100
1:50 000	—	12.68	100
Geochemical mapping:			
1:250 000	134.70	238.30	64
1:100 000	—	66.00	100
1:50 000	6.63	7.08	52
Total thousand (km)²	1 104.77	2 135.95	66%

Notes:

* % 1975—1985 of total.

Source:

ING, 1985.

area was mapped at 1:50 000 scale in 1981/2/3 by Aquater (Italy) and indications are that the tantalum resources are several orders larger than previously thought. Detailed reserves determinations have only been done for the operating workings and even these are larger than the USBM figure. The unexploited pegmatites have still to be assessed.

The principal tantalum workings are Morrua, Muiane and Marropino in central Zambezia Province. The total Ta_2O_5 reserves at these three workings were estimated at 5.8 kt in 1984 grading 735 ppm (Morrua) and 160 ppm (Marropino and Muiane). These operations are all still working but at reduced output due to the security problem, especially in terms of getting production out. Most of the other pegmatite workings are temporarily out of action pending an improvement in the security situation.

The major tantalum minerals producer is Morrua (66 per cent of reserves) and a project for increasing its output three-fold has been put on ice until the mine's security can be guaranteed. The equipment for this expansion has already been purchased and is being stored in Nampula.

Recently MIREM has been trying to interest foreign companies in the tantalum deposits. Interest has been shown by several US and Japanese companies, but nothing can be finalized until the security situation in the area improves.

In addition to tantalum minerals the pegmatite workings produce semi-precious stones (emeralds, morganite, topaz, tourmaline, aquamarine), monazite, mica scrap, industrial beryl, and pollucite (Li). The lithium minerals are stockpiled at present for lack of a market. At the end of 1985 stocks of tantalite were 6.1 t, microlite 6.7 t, beryl 16.7 t, mica 27.2 t, monazite 39.1 t and pollucite 55.9 t.⁶

In 1983 total employment on the pegmatite operations was 2 009 of which 48 were expatriates, mainly from the GDR and the USSR. In that year

Morrua mine suffered a bandit attack in which 2 Soviet technicians were murdered and 22 abducted. A further two died in captivity, but the rest were later freed by Mozambican forces. Since then all expatriates have been withdrawn from the pegmatite mines.

Copper

All copper production comes from the Mundonguara Mine (ex Edmundian Mine) in Manica Province near the Zimbabwean border, 13 km west of Vila de Manica. The mine used to be run by Lonrho from Zimbabwe who stopped production in 1976 when the border with Zimbabwe was closed. Pre 1976 production was about 3.2 kt of copper concentrate (22 per cent Cu) per annum (Table 3), but it is thought that these figures were inflated to cover for production from Zimbabwe in order to get around the UN sanctions against that country at the time.

The government reopened the mine in 1977 when 557 tons of concentrate were produced (21 per cent Cu). Since then production has been running at about 1 000 tons of concentrate per year. At the end of 1985 stocks of concentrate stood at 731 tons. Projected production for 1986 is 1 640 tons of concentrate (21 per cent Cu).

Mundonguara is an underground mine and in 1983 it had 421 workers, 7 of them expatriates. Mill grades are from 1.2 to 2 per cent copper mainly in chalcopyrite. About 36 kt of ore are milled and concentrated at the mine annually and the concentrate produced grades from 18 to 22 per cent copper. In 1984 reserves were estimated at 280 kt grading 3.1 per cent copper. A project for a detailed evaluation of the reserves has been drawn up but has not as yet been carried out.

Early in 1986 a contract was signed with *Mhangura Copper Mines* (MCM) of Zimbabwe for the refining of 600 tons of concentrate at their Alaska smelter/refinery. MCM is owned by the Zimbabwean state mining company ZMDC and

it is expected that further contracts will be signed for them to take all of the Mundonguara production in future.

Until 1984 the mine was receiving technical services from the GDR, but all of the technicians were withdrawn in that year after several GDR technicians were murdered by bandits in Niassa Province, despite the fact that security at the mine is good, especially since the Zimbabwean National Army moved in to guard the Mutare-Beira corridor.

Asbestos

Anthophyllite asbestos production at Mavita, south-west of Chimoio, has stopped because no markets have been found for the product since the asbestos-cement factory in Beira ceased operations as a result of the closing of the Beira cement plant, in turn due to the security situation at the limestone quarries. In April 1985 the mine suffered a major bandit attack in which all of the plant and equipment were destroyed.

In 1985 55 tons of asbestos were produced, down 96 per cent on the 1 424 tons produced in 1981. At the end of 1985 stocks stood at 2 kt (Table 4). Probable reserves in 1984 were estimated at 12.62 kt of asbestos. In 1983 the mine had 185 workers (no expatriates). Mining operations are labour intensive using opencast pick-and-shovel methods.

Garnets

The Cuamba garnet mine is situated 4 km outside the town of Cuamba in Niassa Province. The alluvial deposit is mined by opencast methods and the garnets are hand picked from the ore. Production was 3.54 tons of gem grade garnets and 6.45 tons of "waste" garnets in 1973. This had fallen to 0.87 tons of gem grade and 6.87 tons of "waste" by 1985. In a 1984 prognostic reserves were put at 80 tons of garnets and in 1983 the operation had 160 workers including 1 expatriate. The deposit will be surveyed to determine detailed reserves in 1986.

Kaolin

The Boa Esperanca kaolin deposit is situated in Ribaue District in Nampula Province. The deposit has been mined since 1952 by opencast manual methods. As the deposit has never been surveyed there are no reserve figures for it.

The kaolin is washed and sorted at the mine site. Production of kaolin increased from 100 tons in 1973 to 297 tons in 1981 before falling to 152 tons in 1985 when production stopped due to the deteriorating security situation. In 1983 there were 50 workers on the site (no expatriates). Up to 1983 feldspar was also produced but reserves were exhausted in that year.

Feldspar

Since 1984 all feldspar production has come from the Tulua deposit 30 km from the Port of Nacala in Nampula Province. Opencast manual mining started in mid-1984. Due to the security situation it has not been possible to survey the deposit, hence there is no data on reserves. In 1985 200 tons of crushed feldspar were produced for the glass industry. Installed milling capacity is 2.5 kt/year.

Marble

The Montepuez marble deposit is located 5 km north of the district capital of the same name, in Cabo Delgado Province. Both marble blocks and chips are produced. The quarry is particularly known for its "snow white" marble but other types are also produced. In 1985 the quarry produced 715 m³ of marble, 69 per cent for export. The operation is due to be linked to the national electricity grid in the near future.

Planned production for 1986 is 2 500 m³ increasing to 10 000 m³ in 1988 when an Italian company (Technostone) will come in as joint partners or as technical consultants. The contract is still under negotiation. In 1984 reserves were estimated at 25 800 m³ and in 1983 the quarry employed 106 workers including 6 expatriates.

Table 7

Mineral resources

Mineral	Resources
Apatite	125.3 Mt
Asbestos	500.0 kt
Bauxites	130.0 kt
Bentonite	1.0 Mt
Chalk	40.2 kt
Coal	7.5 Gt
Copper	100.0 kt
Diatomite earth	1.3 Mt
Feldspar	1.0 Mt
Fluorite	1.1 Mt + +
Gold	47.0 t
Graphite	40.0 Mt**
Guano	900.0 kt
Heavy mins (Ti)	118.0 Mt*
Iron ore	64.0 Mt
Kaolin	2.0 Mt
Limestone	38.8 Mt
Marble	29.8 Mm ³
Mica	72.0 kt
Natural gas	120.0 Gm ³
Nepheline syenites	4.3 Gt
Perlite	954.0 kt
Red clay	11.9 Mt
Silica sand	11.5 Mt
Tantalum pentoxide	20.0 kt***
White clay	6.4 Mt

Notes:

* 20 Mt (more than 5 % economic heavy minerals), 25 Mt (9.6 %), 18 Mt (3.5 %) and 55 Mt offshore.

** 35.5 Mt at 15–20 % carbon.

+ + Mt Muambe only.

*** Author's "guesstimate".

Sources:

CNP, 1985; UNDP, 1986; MIREM, 1986a & b; DSGM, 1974.

Bentonite

The Luzinada bentonite deposit is situated 35 km south-west of the capital city Maputo. Production started in 1967 and it is an opencast operation using front-end loaders. The ore is milled,

dried and activated with sodium carbonate near the mine site. Its main uses are in the foundry industry, as an insulator in the construction industry, as a lubricant for drilling and it is used in animal feeds.

Installed treatment capacity is 6 kt/year and in 1985 production was 361 tons, 75 per cent down on 1982 (1 455 tons) due to security problems in the area (Tables 3 and 4). In 1984 reserves were put at 2 452 kt and in 1983 the mining operation employed 24 workers (no expatriates). Negotiations are underway with several foreign companies with a view to turning this operation into a joint venture or to privatise it completely.

Cement

Mozambique has three cement plants. One in the south, outside Maputo (Matola), one in the centre outside Beira (Dondo) and one in the north at the port of Nacala. In 1978 185 kt worth 5.6 M USD were exported and 354 kt were produced. By 1984 production had declined 110 kt and exports to 26 kt (Tables 3 and 5). Production of asbestos-cement sheeting peaked in 1977 at 9 km³ before falling to 2.7 km³ in 1984.

Banditry has particularly affected the limestone quarries supplying the Maputo and Beira plants and quarrying has all but ceased in these two. Paradoxically, the Maputo plant has recently been forced to import clinker from South Africa at the same time as the bandits who caused the quarry to close are being supplied by that country. The Nacala plant has managed to continue production, but at reduced output.

Mozambique has ample limestone resources and in 1984 total national reserves were put at 38.8 Mt. Reserves for the Maputo and Beira plants have been secured for the next 20 years while those of the Nacala plant quarry are under investigation.

Bauxite

In December 1984 a contract was signed

with E C Meikle (Pvt) Ltd of Zimbabwe whereby their bauxite mine (Alumen) on the border of Mozambique at Penhalonga could mine the extension of the deposit into Mozambique. In 1983 23 kt was produced on the Zimbabwean side. The bauxite grades about 60 per cent Al_2O_3 and is used for the production of aluminium sulphate for water treatment by Zimphos Ltd. (AECI) in Zimbabwe.

From the above discussion it is apparent that the Mozambican mining industry was small and underdeveloped even before the contraction since 1981 due to the deteriorating security situation. With the exception of coal and copper, most mining is at an artisanal level using opencast labour intensive methods.

EXPLORATION

An interesting aspect of the geology of Mozambique is that, for the centre and south of the country, the geological and political borders are virtually the same. Whether this was because Rhodes had realized the relationship between the stable cratons and mineral resources or whether the highlands were considered preferable due to their mild climate and absence of tropical diseases, particularly malaria, is not known. But either way the borders or southern Mozambique correspond to the limits of the infertile sandy Cretaceous to Recent low-lying sediments containing few mineral resources (except natural gas), while Zimbabwe and South Africa contain the whole of the two major mineral-rich stable cratons within them, the Zimbabwe craton and the Kaap-Vaal craton.

The northern part of Mozambique contains rocks virtually exclusively of the pre-Cambrian "migmatitic-gneissic complexes" (mobile belts), except for the Metangula Karroo Graben in the north-west and the Rovuma Basin in the north-east while Tete Province contains the Karroo sediments (coal-bearing) of the Zambezi Rift and pre-Cambrian

rocks of a "Migmatitic-gneissic complex."

At independence in 1975 most of the country was geologically unknown. Virtually all deposits had been found by hunters and prospectors and less than two-thirds of the country had been mapped at 1:250 000 scale. Large areas of the north had not even been topographically mapped.

The primary task on gaining independence was therefore one of surveying the country in order to assess the mineral potential. In this respect large advances were made from 1975 to 1983 when most exploration work had to be abandoned due to the increasing South African sponsored banditry in the countryside.

The majority (66 per cent) of systematic geological, geochemical and geophysical mapping of Mozambique has been done since independence (Table 6).

This effort is all the more significant when considered against the virtually non-existent mineral exploration infrastructure left by the departing Portuguese colonial authorities. At independence there were five professionals, three drillers, two draughtsmen and 13 trained assistants, all of them foreign except for 3 assistants. By 1985 there were 11 professionals, 23 draftsmen and 330 qualified assistants, all nationals.⁷ In addition, the ING has about 20 expatriate technicians, generally as part of bilateral agreements.

The main foreign companies working in exploration since 1975 have been:

- LKAB (Sweden), coal, tin and iron ore
- BIC (Integrated Complex Brigade: USSR), pegmatites, coal, graphite and others
- Limex (GDR), pegmatites and coal
- Huntings (UK), airborne geophysical mapping and geological mapping
- BRGM, (France) airborne geophysical mapping and geological mapping, and
- Aquater (Italy), geological mapping and titanium.

This large investment in exploration since 1975 had the following three objectives: a) The formation of a national skilled manpower base for mineral exploration; b) The creation of an inventory of mineral resources through geological exploration; c) The reactivation of the existing mining industry.

Of these three the first two have been successfully pursued while some headway was made in reactivating existing mines before the deterioration of the security situation from 1981. In 1981 there were 52 geological brigades operating in various parts of the country. By 1986 there were virtually none.

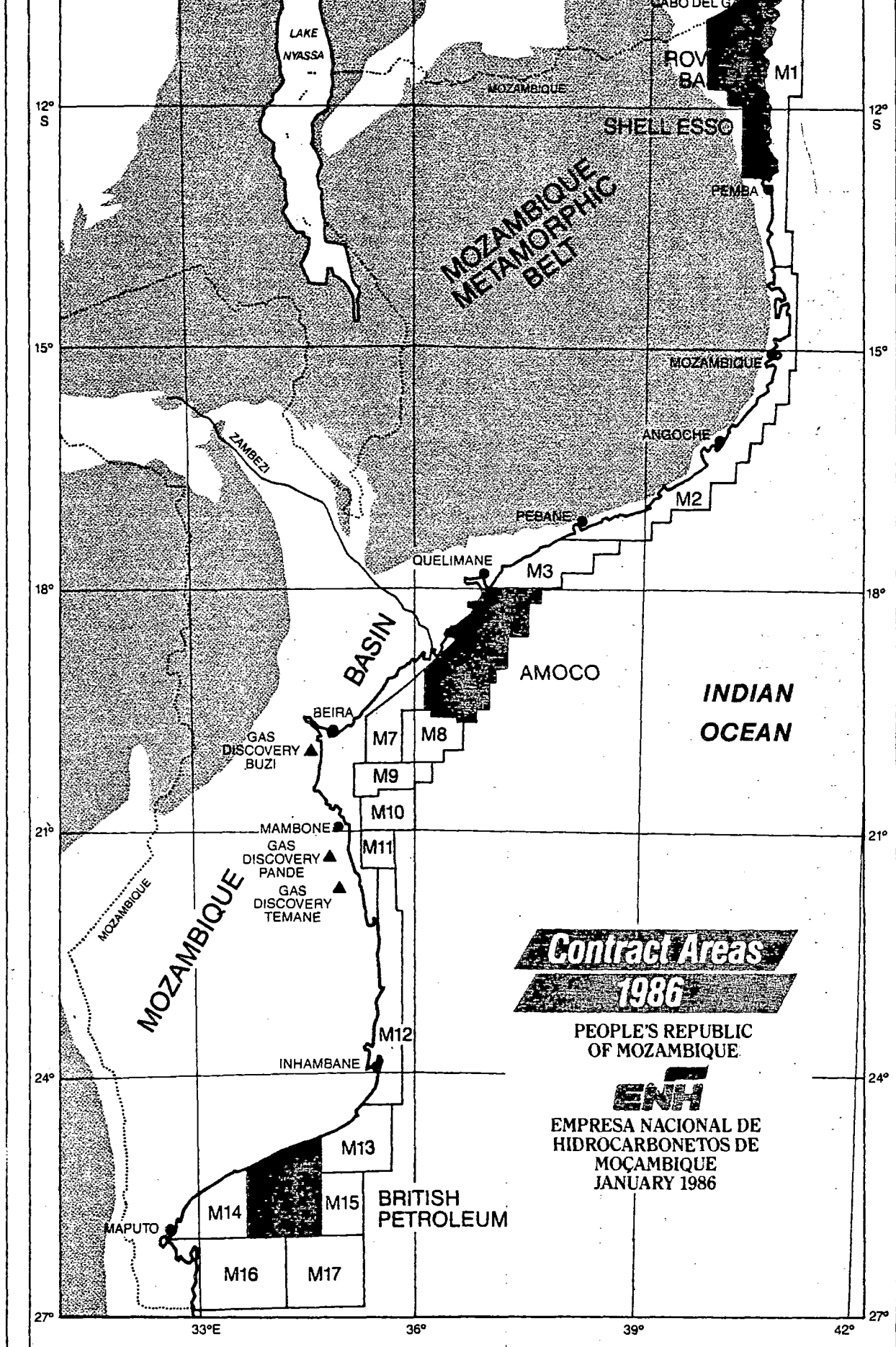
At 1:250 000 scale the work has already been done for the coverage of over 90 per cent of the country and a new national geological map at 1:1 000 000 scale will be published in 1986.

Hydrocarbons

A limited amount of oil and gas exploration took place before independence mainly in onshore and nearshore areas between Maputo and Beira by Gulf, Amoco, Aquitaine, Hunt and Sunray. During this period three gas fields were discovered, at Pande (60 Gm³) and two smaller deposits at Buzi and Temane, but were not developed at the time.

In 1980 the state oil company, Empresa Nacional de Hidrocarbonetos de Mocambique (ENH), was created and it has recently negotiated a contract with the USSR (Tecnoexport) to do a re-evaluation of the Pande gas deposit by seismics and drilling (four holes, each up to 1.5 km deep). The objectives of the project are firstly to confirm the reserves of the known Pande field and secondly to investigate a possible additional field close to Pande. The project will go ahead as soon as the security situation allows, probably in the second half of 1986.

Soon after the formation of ENH contracts were negotiated with Western Geophysical and the Geophysical Company of Norway (GECO) for a speculative survey over the whole length of the



**Contract Areas
1986**

PEOPLE'S REPUBLIC
OF MOZAMBIQUE



EMPRESA NACIONAL DE
HIDROCARBONETOS DE
MOÇAMBIQUE
JANUARY 1986

BRITISH
PETROLEUM

continental shelf. In the same year a new petroleum law was passed and a model production sharing agreement was drafted.

In 1983 and 1984, ENH signed exploration and production contracts with four oil companies. Esso/Shell took an onshore concession in the Rovuma Basin on the border with Tanzania and after detailed seismic surveys in 1985 they started drilling in April 1986 (to a maximum depth of 3.8 km). They have a production sharing agreement with ENH for any future oil extraction. Amoco took four blocks off the Zambezi delta where Hunt drilled two (dry) wells in the early seventies and BP Petroleum Development took a concession offshore over the African Rift extension in southern Mozambique off the mouth of the Limpopo. After doing more detailed seismics, BP are currently looking for partners to share the drilling risk (see Map for concession areas).

In addition, the Japanese state oil company, JNOC, completed a shallow-water seismic survey of Bazaruto Bay in 1984 and ENH have done an extension to this south of Beira, with promising results.⁸ Lake Niassa (Malawi) is also being seismically surveyed by Duke University of the USA.

PROSPECTS

In 1985 the National Planning Commission (CNP) gave a breakdown of major mineral resources investigated to date.⁹ These are given in Table 7. In addition, mention is made of gold resources (Manica), graphites (Monapo), tantalum (Zambezia) and titanium sands (Zambezia). In 1986 the Mozambique UNDP project gave additional resource figures for these minerals which are listed at the end of Table 7.

Since 1983 the Ministry of Mineral Resources (MIREM) has been canvassing foreign investors for the development of the country's mineral resources. The following are the principal prospects:

Gold

In April 1986 Lonrho Plc signed a contract with MIREM, valid for 25 years, for exploration and mining rights for gold in five blocks (12 000 ha) in Manica Province on the border with Zimbabwe. In the first phase a joint mining company to be called *Manica Gold Mines Ltd* (20 per cent State, 80 per cent Lonrho) will be formed to carry out operations. The blocks contain primary deposits of gold in the extension into Mozambique of the Mutare Gold Belt. Lonrho's Redwing gold mine in Zimbabwe is on the other side of the border near Penhalonga and exploration work, starting June 1986, will be carried out by Lonrho Zimbabwe although the contract is with Lonrho Plc in London. This area has several old gold mines (over 30) that were worked in the past.

An alluvial gold block is being negotiated with Lonrho and a contract is expected to be signed shortly which will cover not only this (alluvial) block but also the alluvial prospects in the aforesaid five (primary) blocks. There is still one primary block, in the same area, out on tender.

Diatomite

Deposits of high grade diatomite earth occur in Maputo (Boane) and Manhica Districts. Several companies are bidding for the exploitation rights to the deposits. Neighbouring South Africa offers an excellent market as it consumes about 18 kt/year, 95 per cent of it imported from the USA.

Titanium

There are significant reserves of titanium sands on the beaches of Mozambique particularly between the port of Quelimane and Angoche. In 1959 ilmenite from Pebane was exported to the UK. A large deposit was located off the Zambezi delta in 30 to 60 m of water in the early seventies by the Geological Survey of the FRG, containing 55 Mt of heavy minerals (91 per cent ilmenite).

In 1983 Aquater (Italy) started a project to determine the reserves in the Quelimane area which has just finished. Provisional estimates are 24.9 Mt grading about 10 per cent economic heavy minerals (94 per cent ilmenite). Studies by a Yugoslavian team have come up with 20 Mt of economic heavy minerals (5 per cent cut-off grade) for the Angoche area and a recent study of the dunes and beaches around the mouth of the Limpopo determined 18 Mt of economic heavy minerals grading 3.5 per cent.¹⁰

Current interest is centered on the coastal strip between Quelimane and Angoche and preliminary negotiations have been held with several foreign (US) companies for the exploitation of these reserves.

Tantalum-niobium

Several foreign mining companies (US and Japan) have recently shown interest in the vast tantalum-niobium pegmatite field of central Zambezia Province, but nothing can be finalized until the security situation improves.

Rare earths

There are a series of pegmatites containing significant rare earth grades west of the Ta-Nb pegmatites in Zambezia and Nampula Provinces. They have yet to undergo systematic geological appraisal which would be difficult to carry out under the present security situation. Japanese and American companies have shown interest in these deposits, pending the cessation of banditry in the area.

Graphite

Graphite deposits occur in numerous locations in the centre and north of the country. Graphite was mined on and off from 1911 in Tete (Angonia) and Nampula Provinces but all operations were abandoned in the early fifties.

The most promising deposit in terms of both grade and infrastructure is situated at Ancuabe near the mouth of the

Lurio River, SSW of the port of Pemba. Reserves for this deposit are estimated at 35.5 Mt of flakey grade graphite with 15 to 20 per cent carbon. MIREM has recently been trying to attract foreign partners for the development of this deposit.

Apatite

An apatite occurrence near Monapo on the line of rail south-west of the port of Nacala has recently been surveyed by Intergeo (Czechoslovakia). The ore grades 9 per cent P_2O_5 , 7 per cent FeO, 4 per cent MgO and 1 per cent TiO_2 . Reserves of phosphate are put at 15 Mt. The area also has a good infrastructure in terms of rail and road access and electricity supply. A feasibility study will be carried out in 1986 after which it is hoped that production will start to provide the raw material for a local phosphate fertilizer industry.

Tin

Cassiterite has been mined intermittently from the Inchope deposit since 1919, but ceased in the late fifties. This deposit, of pegmatite origin, is situated close to the line of rail and the main highway between Chimoio and Beira in the centre of the country. The area was re-surveyed in 1978 and significant anomalies of tin, tantalum and niobium were encountered. Grades of 390 to 680 g/m³ of tin and 25 g/m³ of Ta-Nb were found over a wide area.

MIREM is currently looking for finance for a detailed evaluation of this resource, but since the collapse of the tin market there is unlikely to be much interest.

Other minerals

There are several other prospects for which MIREM has been looking for potential investors/partners. These include the Moatize coal fields, the Mt Muambe carbonatites, the Djanguire and Mt Domba fluorites and the polymetallic deposits of the Mueda Plateau in Cabo Delgado, but as yet not much

interest has been shown in these.

Natural gas

In 1983 ENH commissioned a feasibility study on the Pande gas resource by Fluor Corp and Arthur D Little. This study concluded that an ammonia plant producing 365 Kt/year, located on the coast at Inhassoro, would be viable. The study was for a self-sufficient operation with its own power generation and processing local groundwater in the plant, with its own marine facilities.¹⁰

ENH is at present negotiating investment for this project which will be a joint venture with outside capital. Both the World Bank and the African Development Bank have shown interest. The project has also been taken up as a regional project by the SADCC industrial coordination division. In 1984 the total investment needed was 182 M USD of which pledges for 66 M USD had been secured.

LEGISLATION

Minerals

Mozambique has, as yet, no mining law. Legislation has been drafted with the help of The Commonwealth Secretariat based on the Botswana and Tanzanian laws, but still has to be passed by Parliament (Popular Assembly). The new mining and minerals law will be approved in 1986 and is made up of a relatively brief act containing the broad principles and extensive regulations (promulgated by the Cabinet).

Subsequent to the Moatize colliery disaster in 1977, extensive mining safety regulations, for both opencast and underground operations, were drawn up and passed in 1981.¹¹

To date contracts have been signed with foreign companies on a case by case basis with a "Heads of Agreement" contract. These prospecting and mining codes are the same except for a few, company specific, details. The agreement covers the area, the mineral/s to be pro-

spected for, the period and the conditions for relinquishing the concession.

Periods: There is a general survey period (three years and can be extended one year at a time), after which there is a feasibility study period (one year), then a mine development period (two years with negotiable extensions) and finally a production period of twenty-five years which is renegotiable at the end. Each period has a minimum work program and expenditure.¹²

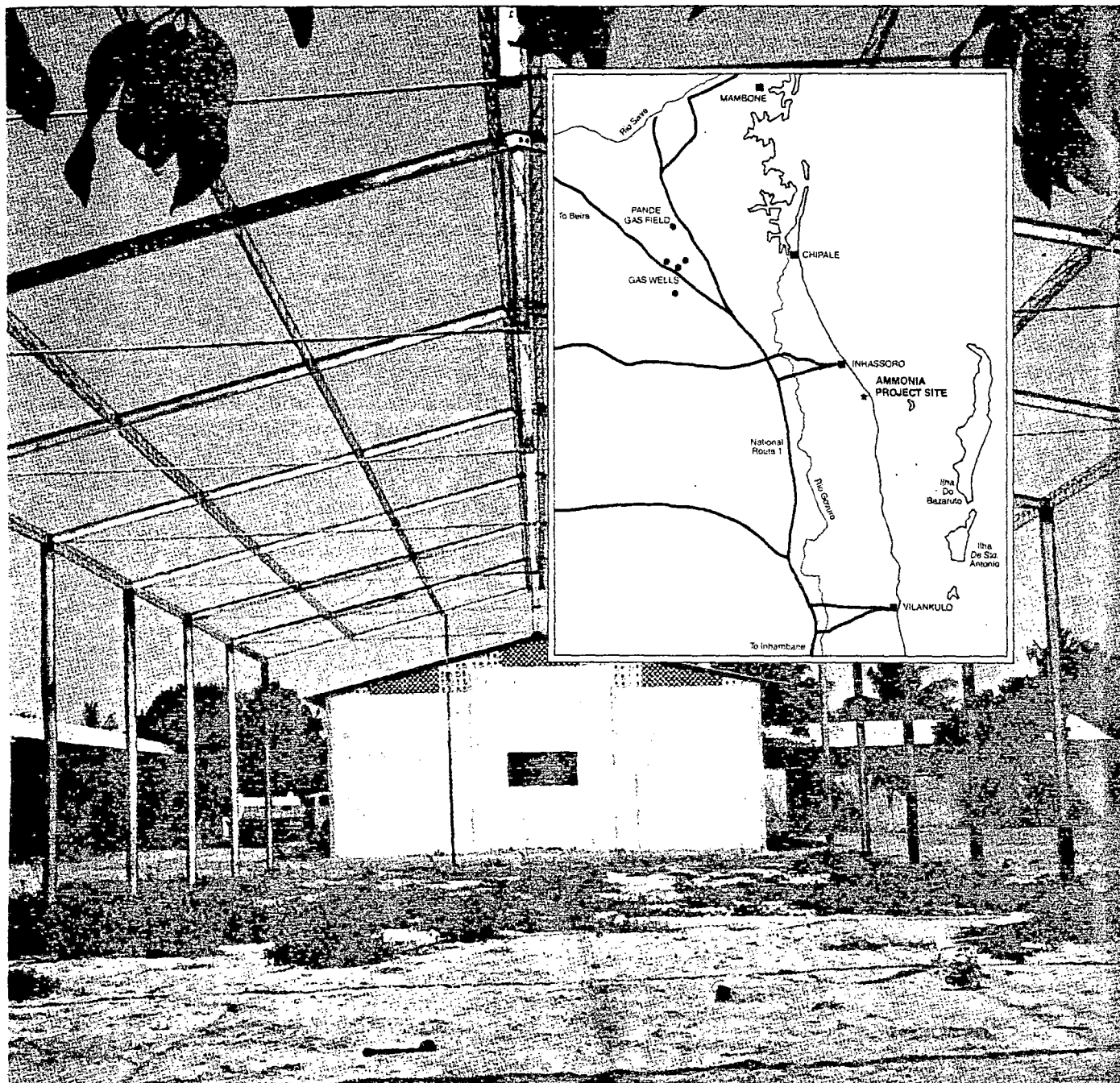
The agreement is mineral specific and the company has to re-apply to include the exploitation of other minerals, but has first preference on them. At any time MIREM has the option of taking up to 50 per cent of the equity of the local mining company and there is usually a clause on the maximization of the employment and training of Mozambican personnel.

Financial: All exploration expenditure must be in foreign currency and is at the sole risk of the investor. The concession land (block) rental is negotiable, but is usually from 0.02 USD to 1 USD per hectare depending on the mineral/s and is different for each of the above periods, usually increasing with time. Mining royalties are on the gross value of production and are negotiable (usually less than 10 per cent). There is provision for exemption from import duties for equipment and raw materials, and from export duties on the mineral/s produced.¹³

Taxation is at the standard company tax rate of 50 per cent of profits, but there is provision for an Additional Profit Tax (APT) for exceptionally high rates of return. All pre-production expenditure can either be converted into equity for the (joint) production company or can be recovered. All after tax profits can be repatriated, but no local borrowing is allowed for the initial exploration and production capital.

Under the Foreign Investment Law of 1984¹⁴ arbitration of disputes regarding the interpretation and application of the contract is done by an arbitration com-

*Exploration camp under construction,
Vilankulo.*



mittee nominated by the two parties. Failing that, by the International Chamber of Commerce in Paris.¹⁵

Hydrocarbons

In 1981 the law regulating petroleum activity was approved. Under it all concessions are given to ENH which is then

permitted to enter into contracts with foreign companies for the exploration and development of the concession. The law also has regulations regarding the protection of hydrocarbon resources and the environment, gas flaring, petroleum export rights, the employment and training of national personnel and the

use of local goods and services.¹⁶

In 1983 and 1984 ENH entered into three production sharing contracts with oil transnationals (Esso/Shell, Amoco and BP). The salient features of these contracts are: An initial exploration period of three years with two optional extensions of two years and 25 per cent

of the concession will be given up after the first three years and a further 25 per cent after the first two year extension; a development period of 20 years, a 15 per cent royalty on all production; an after tax and royalty profit division between the company and ENH according to the production sharing scale (variable); and, a tax exemption from essentially all tax except for industrial (company) tax at 50 per cent of profits.¹⁷

DISCUSSION

In 1975 the Mozambican mining industry was both undeveloped and backward and the geology (and hence the mineral potential) of the country was only superficially known. The few mines that existed were generally using artisanal, labour intensive methods.

The first priorities of the new socialist government, in the minerals field, were: 1) To keep the existing mines operational in the face of abandonment and the exodus of Portuguese artisans and technicians; 2) To launch an extensive mineral exploration program in order to assess the national mineral potential; and, 3) To train the necessary manpower to effectively carry out the above two.

By 1981 all the mines had been nationalized and mineral production was once again reaching pre-1975 levels. Exploration activity had covered over 90 per cent of the country and several new (and some old) mineral resources had been systematically assessed. Manpower development had progressed rapidly, to the stage where there were several times more qualified nationals than the pre-1975 total of settlers and nationals. The battle on all three fronts appeared to be well in hand if not virtually won.

After the independence of Zimbabwe in early 1980, the South African regime took over the running of the MNR, which had been the creation of the Rhodesian security forces, and with their considerably more extensive resources for the training and supply of

the bandits, the destabilization war was rapidly escalated. By the end of 1983 virtually all mineral exploration activity had been abandoned and the mining industry was collapsing, both due to the banditry in the countryside.

The government then attempted several compromises in an effort to halt

the rapid disintegration of the economy. The first was the Nkomati Accord of March 1984 whereby they tried to halt or at least diminish South Africa's sponsorship of the bandits and to increase its stake in the Mozambican economy, principally in their traditional (pre-1975) areas of invisibles, namely, ports/

Acts of destabilization recorded in the mining sector in Mozambique

1978	Destruction of the Iron Prospecting Camp at Honde.	1983-08-21	Attack on the pegmatitic mine of Morrúa (Zambézia Province), and abduction of 21 Soviet technicians.
1978-08-24	Attack on the Iron Prospecting Brigade at Honde (Manica Province), destruction of 3 vehicles and abduction of 1 worker.	1984/85	Destruction of a truck and a car on the road from Beira to Moatize, carrying material to CARBOMOC.
End of 1978	Attack on the asbestos mine, in Mavita (Manica Province), without any losses.	1984	Destruction of transport equipment (trucks and jeeps) on the road from Muiane to Morrúa (Zambézia Province).
1979-10-12	Manica Gold Project — Death of 4 GDR technicians and another seriously wounded, destruction of a caravan and an "IFA" truck, by deflagration bomb.	August 1984	Attack on the pegmatitic mine of Muiane (Zambézia Province) and the destruction of the water pump.
1980	Destruction, at Save, of a "Mercedes" truck, carrying material to CARBOMOC — Moatize.	December 1984	Attack on Tulua mine (Nampula Province) and the assassination of the Mine Chief.
1981	Destruction, again, of the Iron Prospecting Camp, at Honde.	April 1985	Attack on the asbestos mine at Mavita (Manica Province) destruction of all the existing machinery, factory and office equipment.
1982	Destruction on the Susundenga Road, of a truck and the assassination of the driver.	Source: Ministério dos Recursos Minerais, Maputo, 1986-03-24.	

rail, miners and tourism. At the same time a Western diplomatic offensive was launched with the objective of getting the OECD states to use their leverage on South Africa to cease running the bandits and to exploit the contradictions between Western imperialism and South African sub-imperialism.

To achieve this a new policy of encouraging Western foreign investment was launched to the extent of part-privatising state enterprises, but generally to be run as joint state/TNC operations. The foreign investment regime was changed to the degree that it is now more favourable than that of neighbouring countries. Repatriation of after tax profits is 100 per cent for Mozambican mining companies, 50 per cent in Zambia and a mere 35 per cent in Zimbabwe.

To date the results of these two strategies have been mixed: In South Africa's case there has been only a marginal decrease in their support to the bandits and an insignificant increase in their involvement in the port of Maputo, tourism and the recruitment of miners. Regarding the West, there has been increased pressure from some quarters on South Africa to stop its destabilization policy, but to no great effect, while there has been significant interest in the opening up of the economy to foreign investment, though not much action, mainly due to the security situation. In a negative sense, it can be argued that the government has achieved the victory of the USA not recognising and supporting the MNR, as they have in UNITA's case in Angola.

In the case of mining, delegations were sent to both Japan and the USA in early 1986 to canvass investment. Interest was shown for several minerals, specifically titanium, tantalum and rare earths (see "prospects" section). The only foreign investment contracts signed to date are for petroleum (Esso/Shell, Amoco and BP), where the process started as far back as 1983 and gold (Lonrho) where exploration should start in the

near future and falls within the relatively secure Beira corridor zone. South African concerns have shown interest in both the diatomite and bentonite resources of Maputo Province.

It appears that further Western investment is dependent on an improvement in the security situation which is in turn in part dependent on the West to pressurise South Africa into dropping their support for the bandits.

At a regional level (SADCC), the proposed urea plant based on Pande natural gas has been taken up as a SADCC project and a project for the assessment of Mozambique's lime resources is in the pipeline. Contracts have already been signed for the refining of Mozambican copper concentrates in Zimbabwe, for the mining of Mozambican bauxite by a Zimbabwean company and further areas of collaboration are under investigation.

In conclusion, Mozambique has extensive mineral resources, but their development is entirely dependent on an improvement in the security situation, brought about by South Africa's policy of regional destalinization which is in turn dependent on the state of the anti-apartheid struggle in that country and on the extent of collaboration with that country by Western capital.

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